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15 February 1954

MEMORANDUM FOR: CHIEF, GENERAL PHYSICS BRANCH

SUBJECT: Subminiature Recorder

REFERENCE: [redacted] proposal for Subminature Recorder. 25X1

1. Introduction - A proposal was submitted by [redacted] for a study of basic recorder techniques to determine optimum design specifications. The basis for this proposal was that the best fundamental system to be used in subminiature recording was not obvious. 25X1

2. Discussion - Instead of criticizing the rather novel (if nothing else!) ideas for recording suggested in the proposal, it will suffice to evaluate the wire recording technique which, though not obviously fundamentally the best, will be quite satisfactory.

3. Ad hoc specifications were -

a. Duration of response: at least 30 minutes.

b. Frequency response : 0-2500 cycles/sec.

c. Power supply : self-contained

d. Weight : not more than one pound

e. Dimensions : not greater than 3/4" x 4" x 5"

4. The recording problem consists of:-

a. Obtaining most efficient use of the resolving power of the storing device (Maximum resolving power of most common storing devices is approximately one thousandth to 10 thousandths of an inch).

b. Obtaining a recording means of low energy and of high resolution.

c. Utilizing low energy drive.

Note that it is a mistake to consider problems a and b separately.

All storing devices in the proposal were essentially two-dimensional. To obtain the most efficient use of the storing area,

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tolerances of about 10^{-5} in. are required. As some part of the recording motion in putting successive bits in their proper places must be mechanical to obtain such tolerances are out of the question. However, if wire can be used, bits (i.e. wires containing bits) can be stored next to each other without introducing any such limitation. Wire will give more efficient use of space than any area surface because no precise mechanical action is required to differentiate one bit from successive bits.

The present Minifon wire is 2×10^{-3} in. in diameter. The wire runs at one foot per second. Assuming the maximum frequency response is 2500 cycles/sec., this then means that the resolving power along the wire is approximately 5×10^{-3} in./cycle. This approaches the maximum resolving power obtainable in common storing devices. In addition, it should be noted that with a 2×10^{-3} in. diameter wire, the resultant "area" of storage is in the order of magnitude desired. Resolution can be increased by reducing the wire diameter and by increasing the resolving power of the magnetic head. Both of these have been done. This storing mechanism solves problem a. and part of problem b..

In the wire recorder, as in all other types of recorders, recording resolution is the limiting factor. Power requirements are sufficiently low. Concentration of the field, however, has not been optimum. Work has been done along these lines in TV magnetic tape recording with success. Regardless of much improvement, however, problem b. is sufficiently answered by present techniques to meet specifications.

The problem of low-energy drive remains. In the Minifon approximately one-quarter of the space is taken by the battery to drive the motor. A spring-wound, one-shot driving mechanism would greatly reduce the size. Neither the rotating of the wire spools nor the friction of the wire against the head need be limiting relative to other practical recording methods, however; and for any recording method where the storing means must move, the mere rotation of spools must compete with these.

5. Conclusion * In view of the above, a satisfactory system of recording is obvious within practical limitations. As a final assertment of this statement, it should be noted that ASD is developing a wire recorder which will approximately meet the specifications stated here. Their device should be in production within two or three months. In the meantime, [redacted] will follow their project, in addition to coordinating our development of a magnetic wire eraser suitable to their spools. 25X1

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